7.3 Lab Activity

**Testing Le Chatelier’s Principle**

Many chemical reactions are considered to proceed to completion, but at the molecular level nearly all chemical reactions may in principle be reversible. If the concentration of the reactants or products in a chemical reaction should change, the concentration of all other species must change in order to maintain the same value of the equilibrium constant (Kc). This idea is stated as Le Chatelier’s Principle:

*If a stress is applied to a system at chemical equilibrium, the equilibrium will shift in such a manner as to counteract the effects of that stress.*

Le Chatelier’s principle describes what happens to a system at equilibrium when disturbed and must reestablish equilibrium. In the following lab we will investigate this principle.

**Question**

How do applying stresses to particular chemical equilibria affect the system?

**Materials**

* Eye protection
* Lab apron
* Test tubes (5)
* Droppers (3)
* Stoppers (5)
* Test tube rack
* 50mL beaker (7)
* Marker
* Water
* 100mL Graduated Cylinder (1)
* 5mL Graduated Cylinder (4)
* Concentrated HCl (ie 12M) – 3mL
* 0.1M CoCl2  - 2mL
* 0.1M FeCl3  - 3mL
* 0.1M KSCN – 3mL
* 0.1M AgNO3  - 1mL

**Procedure**

 HCl is an extremely hazardous corrosive acid.

Obtain all necessary solutions and equipment prior to starting the lab.

As you carry out the following procedure, record your observations in your laboratory notebook.

Reaction #1

Co(H2O)62+(aq) + 4Cl-(aq)eqarrow CoCl42-(aq) + H2O(l)

1. Fill a test tube with 2mL of 0.1M CoCl2 and observe the result. (pink solution)
2. Add 3mL of HCl dropwise to the test tube containing the CoCl2. (turns blue)
3. Add water dropwise to the solution from step #2 until the reverse reaction is evident. (turns pink)
4. Write an equilibrium expression for this reaction. K=[CoCl42-][H2O]/[Co(H2O)62+][Cl-]4

Reaction #2

Fe3+(aq) + SCN-(aq)eqarrow FeSCN2+(aq)

1. If you are the first group at this station, prepare a stock solution by mixing 2mL of 0.1M FeCl3 and 2mL 0.1M KSCN in a 100-mL graduated cylinder adding H2O to bring the volume to 100mL. Save this stock solution for the rest of the class. (light red/orange)
2. Design a procedure to demonstrate Le Chatelier’s principle satisfying the following parameters and using the above stock solution and the substances listed below:

Parameters:

Must have a change in colour.

Must have a return to original colour.

Must use all 4 solutions supplied (solutions can be used more than once).

Use 5mL or less of each solution in each step.

Solutions:

0.1M FeCl3

0.1M KSCN

0.1M AgNO3

Potential Procedure:

1. Take 5mL of the stock solution and note the colour. Add about 1mL of 0.1M FeCl3 solution and observe the results. (turns darker red/orange)
2. Take 5mL of the stock solution and note the colour. Add about 1mL of 0.1M KSCN solution and observe the results. (turns darker red/orange)
3. Take 5mL of the stock solution and note the colour. Add about 1mL of 0.1M AgNO3 solution dropwise until almost all the colour is gone. Split the solution into two test tubes including the precipitate. (turns clear with white precipitates)
4. Add 2mL of 0.1M KSCN dropwise to one test tube and observe the results. (turns red/orange)
5. Add 2mL OF 0.1M FeCl3 dropwise to the second test tube and observe the results. (turns red/orange)
6. Show your procedure to your teacher and have her approve your steps and amounts of solutions used in each step.
7. Conduct your procedure and record your observations.

Dispose of all solutions according to your teacher’s instructions. Clean up your work area.